Spider family richness and habitat complexity

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Abstract

A survey of spiders was conducted at a location in the Yarra Valley over 8 days to assess the relationship between habitat structure and spider family richness. Four different habitat types were sampled: slightly disturbed grazed pasture, disturbed grazed pasture, open dry forest and dense dry forest. Six different trapping methods were used. Spider families were richer in the more complex forest sites, and less rich in the less complex pasture habitats. When broken down into groups based on hunting strategy, fewer groups were found in the pasture sites, while more hunting strategy groups were present in the forest sites. Non web-building and ground-hunting spiders dominated the pasture sites. These groups were present in the forest sites, but web-building spiders were also found. This is attributed to the more complex vegetation, which provides greater habitat opportunities. The results support the hypothesis that spider family richness is related to habitat structure. (*The Victorian Naturalist* **126** (1) 2009, 18-22)

Keywords: spider diversity, habitat structure, hunting strategy

Introduction

Spiders are adapted to many varied habitats, and show a wide variety of hunting strategies for these differing environments. Brunet (1994) identifies four general groups of hunting strategies: open-range hunters, ambushers/anglers, apprentice weavers and master weavers. Open-range hunters actively pursue prey, and do not rely on snares to capture prey. Ambushers and anglers use many different techniques, including casting nets, hiding and using pheromones to attract particular insects. Apprentice weavers use permanent silk webs to snare prey, and generally weave sheet webs, lattice webs and unrefined wheel webs. In contrast, the master weavers only weave wheel webs, of which there are many kinds. These spiders erect temporary webs, and can therefore move to take advantage of plentiful food supplies.

Regardless of hunting strategy, all spiders have certain habitat requirements; if these are unfulfilled, habitats become unsuitable. Environments with a wide diversity of plant species and greater structural complexity are likely to fulfil the habitat requirements of more species of spiders than an environment with less plant diversity and less structural complexity.

The aim of this study was to examine the relationship, if one exists, between habitat structure and spider family richness. It would be expected that a more complex habitat structure would house a greater number of spider families. This study was undertaken by the author as a Year 10 school project.

Methods

Study sites

Sampling took place at four sites located in Wonga Park, Victoria. Each site was divided into three separate 10 m by 10 m quadrats, and all four sites were located within a 300 m by 200 m area. Habitat structure varied between the four sites.

The lightly grazed paddock site had been grazed by horses until three months prior to the study, and had medium-length, thick grass of an introduced pasture species. Horse dung was scattered around the site, as well as some blackberries *Rubus fruticosus*. The heavily grazed paddock site was grazed by horses at the time of study, and had very short grass, of the same species as the lightly grazed paddock site. Horse dung was present in small clumps throughout the site.

Dry forest site 1 was an open woodland/forest, containing many trees, mainly *Eucalyptus* and *Acacia* species. Litter and debris were abundant, predominately bark and leaves from the larger trees. Dry forest site 2 was similar to dry forest site 1 in regards to plant species, but was much denser and received less sunlight due to the presence of a dense *Leptospermum* understorey. Some grasses and sedges were present, the main proportion being a species of *Gahnia*.

Trapping methods

A total of six trapping methods were used; however, only three methods were used at all sites. The other three methods were not suitable for either of the grazed sites due to the absence of trees and the difficulty in collecting litter. Sampling was undertaken between 17 and 24 March, 2002.

Pitfall trapping was used at all sites, and consisted of plastic cups 60 mm in diameter, approximately half-filled with 70% ethanol. The traps were left out for eight days. Sweeping was done at all sites, using a butterfly net. One sweep was taken per step, with twenty steps taken per quadrat. Beating trays were used at both forest sites. Three trees from each quadrat were sampled using a beating tray. A bark search was undertaken at both forest sites. Two trees were sampled in each quadrat. A Rietter sieve was used to sieve the litter at both forest sites. In each quadrat, a 1 m by 1 m square was sieved. A direct search was undertaken at all sites. This was a general search of each quadrat, a method used mainly to collect orb-weaving spiders.

Sorting and Identification

Spiders were identified to family using keys and pictures in Brunet (1994; 1996), Child (1965), Clyne (1969), Davies (1986), Main (1964), Mascord (1970; 1978), Shield (2001) and Walker and Milledge (1992).

Results

A total of 666 spider specimens were found across the four sites, belonging to 18 different families. Six different spider families were collected in the paddock sites, as opposed to 17 in the forest sites (Table 1). Spider family richness was shown to be greater in the forest sites (Fig. 1); however, the forest sites did not necessarily have a greater abundance of individuals (Fig. 2). When broken down into four groups based on hunting strategy, both forest sites had representatives from all four groups, while the grazed paddock sites were dominated by families from the open-range hunter group and the ambusher/angler group (Fig. 3). The two grazed sites had no specimens from the apprentice weaver group, and only one specimen from the master weaver group.

Discussion

The results of this study provide strong evidence of a link between spider family richness and habitat complexity. At the grazed sites, the only vegetation was an introduced species of pasture grass, whereas the vegetation in the forest sites was much more complex. More families of spiders were present in the forest sites than in the grazed sites (Fig. 1). More spider families were present in the lightly grazed paddock site than in the heavily grazed paddock site (Fig. 1). While both sites were dominated by the same species of grass, the lightly grazed paddock site had much longer grass, providing a more complex habitat. This also reinforces the hypothesis that spider family richness is directly related to habitat structure and complexity.

The results suggest that the heavily grazed paddock site may have had more individual specimens than dry forest site 2, and almost as many as dry forest site 1 (Fig. 2). However, the majority of these specimens were immature members of the Lycosidae family, and due to the large standard error, this is not conclusive. The large number of lycosids sampled would suggest that a less complex environment can still be highly productive for specialist groups.

When grouped according to hunting strategy, the results again support the hypothesis that increased habitat complexity increases spider family richness. Members of all hunting strategy groups were sampled in the forest sites, while the paddock sites were dominated by open-range hunters. Only two of the families sampled in the paddock sites did not belong in the open-range hunter category. Thomisids were collected, as well as one tetragnathid. Thomisidae spiders belong in the ambusher/angler category, and are not uncommon in open grass sites (Brunet 1994). They are spiders of vegetation and leaf litter, but are also found in grass. Spiders from the Tetragnathidae family were not expected in the paddock sites, as these are web-building spiders. The specimen found was a jawed spider. Jawed spiders are usually found on vegetation above or around water; this may have been a chance occurrence, or it is possible that the spider lived in the slightly longer grass neighbouring the site (Brunet 1994). In the forest sites, the presence of overstorey and understorey vegetation facilitates web-building, leaf-curling and snaring. As such, the four major hunting strategy groups are all accommodated, and the results show that this is the case.

An important feature of spiders is their functional significance. Spiders are the top invertebrate predators, and as such they are potential indicators of invertebrate diversity. Greater spider family richness would suggest a greater

Table 1. Number of individuals and total number of spider families from each site.

Family	Lightly Grazed Paddock Site	Heavily Grazed Paddock Site	Dry Forest Site 1	Dry Forest Site 2
Open Range Hunters				
Lycosidae	21	188	17	21
Salticidae	5	2	25	16
Zoridae	2	0	0	0
Oxyopidae	25	3	4	2
Lamponidae	0	0	3	1
Clubionidae	0	0	32	34
Dysderidae	0	0	1	2
Pisauridae	0	0	3	0
Zodariidae	0	0	2	0
Gnaphosidae	0	0	34	6
Corinnidae	0	0	2	0
Ambusher/Anglers				
Thomisidae	28	3	43	18
Apprentice Weavers				
Dictynidae	0	0	1	0
Linyphiidae	0	0	15	3
Theridiidae	0	0	10	24
Nicodamidae	0	0	3	0
Master Weavers				
Araneidae	0	0	6	43
Tetragnathidae	1	0	1	13
Unknown	0	1	2	0
Total no. of families	6	4	17	12

Fig. 1. Mean and standard error of the number of families per 100 m^2 quadrat.

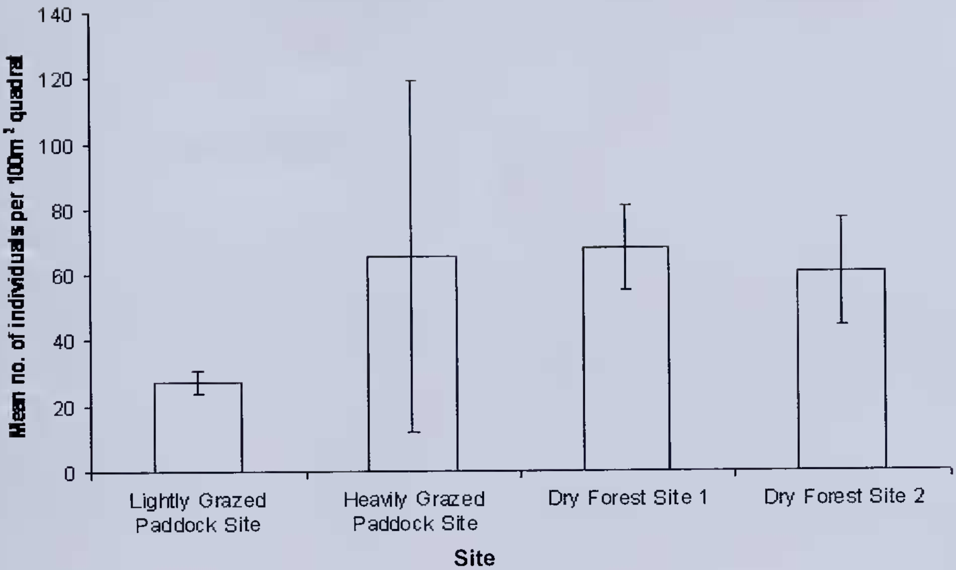

Fig. 2. Mean and standard error of the number of individuals per 100 m^2 quadrat.

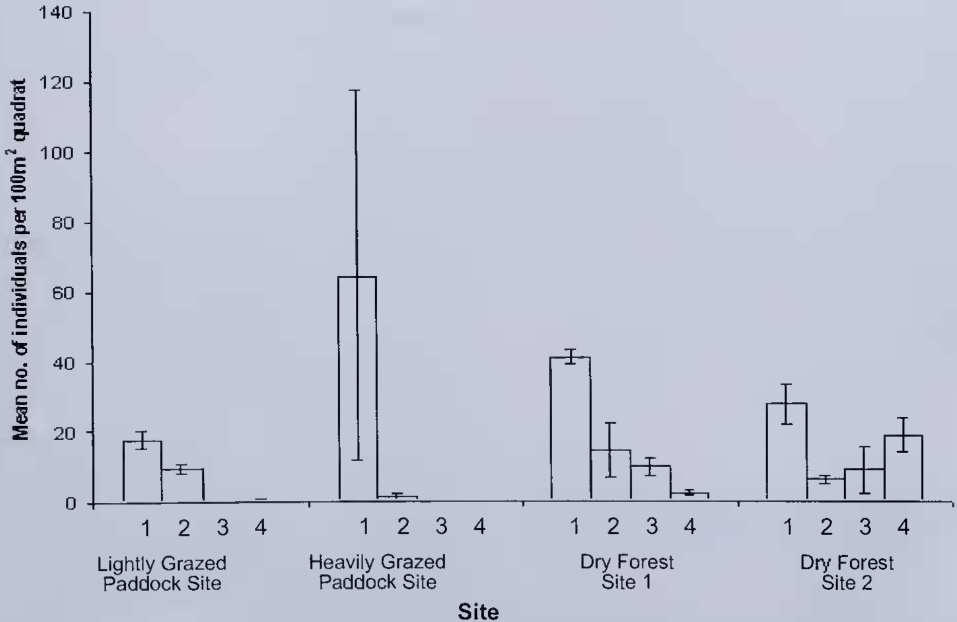

Fig. 3. Mean and standard error of the number of individuals per $100m^2$ quadrat, grouped according to hunting strategy (1 = open range hunter, 2 = ambusher/angler, 3 = apprentice weaver, 4 = master weaver).

diversity of food sources, which, in this case, would be lower level invertebrates. Spider family richness was shown to increase with increasing habitat complexity, therefore it is possible to suggest that more complex habitats may house a greater diversity of lower level invertebrates.

The results suggest a link between habitat complexity and spider family richness, suggesting spider family richness increases with increasing habitat complexity. No link can be found relating habitat complexity and spider abundance. Hunting strategy groups were better represented in more complex sites, suggesting that more complex sites facilitate a more diverse range of hunting strategies for spiders. Finally, while this study dealt only with spiders, the functional significance of spiders means that these results can potentially apply to other invertebrate groups. This would suggest that increasing habitat diversity and structural complexity relates to increasing invertebrate taxon richness.

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